Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	*discontinuous* gender / male and female / eye colour **;** *continuous* size / length / mass **;**	**2**	**Mark the first answer on each prompt line.** If an additional answer is given that is incorrect or contradicts the correct answer, then **= 0 marks** **Note:** Suggestions must relate to **visible** characteristics of the **frogs**, **ACCEPT** sex **IGNORE** skin colour (as stated in Q) **CREDIT** example of a ***measurable*** characteristic (e.g. leg length, surface area, height, weight)
1	(a)	(ii)	*idea of* **1** no / little **,** environmental effect for **,** (named example of) discontinuous variation / example given for discontinuous variation in **(i)** as ecf **;** **2** some / large **,** environmental effect for **,** (named example of) continuous variation / example given for continuous variation in **(i)** as ecf **;** **3** gender may be affected by **,** temperature / atrazine exposure **;**	**2**	**IGNORE** examples of environmental factors **ACCEPT** discontinuous variation is ***only*** **,** genetic / due to alleles present **Note:** A comparative statement (e.g. ' environment has a greater effect on continuous variation') **= 2 marks** (mps 1 & 2) e.g ‘ no environment effect for discontinuous variation but it does affect continuous variation’ **= 2 marks** (mps1 &2)

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(iii)</td><td>1 idea that offspring visibly different from , A / egg donor ;

2 to show that the offspring produced were clones ;

3 to show / identify , (genetic) parents (of clone) / B and C ;</td><td>2 max</td><td>ACCEPT brown frog for A

2 ‘to show that cloning is successful’ is not enough

Note:
‘To show that the offspring were clones as they are not the same as A.’ = 2 marks (mps 1 & 2)</td></tr>
<tr><td>1</td><td>(b)</td><td>(i)</td><td><table><tr><th>Genetic fingerprint number</th><th>Letter of frog</th></tr><tr><td>1</td><td>D</td></tr><tr><td>2</td><td>A</td></tr><tr><td>3</td><td>B</td></tr></table>;
;
;</td><td>3</td><td>Mark the first answer in each box. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks

If no letters in the table <u>at all</u>, look at the diagram and award marks if the profiles are identified correctly.</td></tr>
<tr><td>1</td><td>(b)</td><td>(ii)</td><td>cytoplasm / mitochondria , came from A

or

mitochondria / (mitochondrial) DNA , in cytoplasm of A ;</td><td>1</td><td>If frog not identified correctly = 0 marks

Must refer specifically to frog A

Must refer specifically to frog A</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(i)	*advantage* (genetically identical so) all react the same **or** genetic variable controlled **;** *disadvantage* expensive (to produce) **or** don't see varied response to drug like in real populations (of mice) **or** *idea that* clones (of mice) may have unknown health issue (which would affect responses) **;**	**2**	**Note that the question refers to the use of cloned or uncloned mice in testing – and NOT to humans.** **ACCEPT ora** throughout **IGNORE** large numbers of clones produced **IGNORE** ref to animal welfare / religious objections **IGNORE** ref to validity **ACCEPT** 'no genetic diversity to affect results' **ACCEPT** 'rare allergies / adverse reactions **,** won't be seen'

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>(c)</td><td>(ii)</td><td>1 idea to produce , elite / best , animals ;

2 idea to save / preserve , endangered animals ;

3 grow / produce (spare) , stem cells / tissues / organs ;

4 AVP ;</td><td>2</td><td>IGNORE ref research into disease (as given in Q)
IGNORE ref to cost

1 ACCEPT example / desirable characteristics

2 ACCEPT recreating extinct animals

3 ACCEPT ref to named example of , tissue / organ

4 e.g. pet cloning / cloning GM animals / animals for xenotransplantation</td></tr>
<tr><td>1</td><td>(d)</td><td></td><td><table><tr><th>Individuals</th><th>% of alleles shared</th></tr><tr><td>David and John</td><td>100</td></tr><tr><td>Anne and Lisa</td><td>50</td></tr><tr><td>Sarah and Lisa</td><td>50</td></tr></table>;
;
;</td><td>3</td><td>Mark the first answer in each box. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>17</td><td></td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
2	(a)		(belong to the) same genus ;	1	
2	(b)	(i)	**1** not much / little / some **,** competition / niche overlap **;** *reasons for little competition* **2** use / feed on **,** different sized flowers / different depth of flowers **;** **3** vary in proportions of pollen **and** nectar they collect **;** **4** fly / live / active / feed / visit flowers **,** at different times **;** *reason for competition* **5** *idea that* fly / live / active / feed / visit flowers **,** overlaps there must be competition **;** **6** AVP **;**	**4 max**	**This mark is for a stand alone statement** **DO NOT CREDIT no** competition **IGNORE** competition unqualified / inter / intra **2** **CREDIT** correct comparative description or use of data e.g. *B. pratorum feed* on **,** bigger / longer / deeper **,** flowers **or** *B. pratorum* 7.4(mm) **and** *B. terrestris* 6.3(mm) **3** **CREDIT** correct description e.g. *B. pratorum* mostly pollen and nectar **and** *B. terrestris* mostly nectar only **or** comparison of 2 species using table data **IGNORE** 'different amounts' of pollen and nectar **4** **CREDIT** correct description of difference e.g. *B. pratorum* peak in June **and** *B. terrestris* in July **or** *B. pratorum* appear in earlier in the year **or** comparison of 2 species using graph data **5** **CREDIT** correct description from data e.g. both compete for food between May and September / both collect pollen only from same % flowers **6** e.g. use / feed on **,** different species of flowers

Question			Expected Answer	Mark	Additional Guidance
2	(b)	(ii)	**1** *idea of* isolation / isolating mechanism / barrier **;**		
			2 seasonal (difference) / temporal (difference) / males and queens (in different populations) produced in different months / breeding (in different populations) in different months **;**		**2** **CREDIT** example of seasonal / temporal (e.g. *B. pratorum* has its peak number of workers in June and *B. terrestris* in July)
			3 behavioural (difference) / visit different (types of) flowers / feed at different times / feed on different food types **;**		**3** **CREDIT** 'different mating rituals'
			4 different flower locations / different (micro)habitats **;**		
			5 *idea that* gene flow restricted / no gene flow (between populations) **;**		**5** **must refer to gene /allele**
			6 different adaptations / specialisation / niche partitioning **;**	**3 max**	**6** **IGNORE** speciation (as implied in Q) - can be mistaken for specialisation

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>Observation</th><th>Type of behaviour</th></tr>
<tr><td>The time taken for a worker bee to collect food from a flower decreases with practice.</td><td>learned (behaviour) / learning /
operant conditioning / trial and error ;</td></tr>
<tr><td>All bumble bees start at the bottom of a vertical spike of flowers and work upwards.</td><td>innate / instinctive ;</td></tr>
</table>
</td><td>2</td><td>Mark the first answer in each box. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks

ACCEPT taxis / example of taxis eg chemotaxis
IGNORE inherited / genetically determined
DO NOT CREDIT kinesis</td></tr>
<tr><td>2</td><td>(c)</td><td>(ii)</td><td>Idea that better / more efficient , at , finding / getting , food ;

AVP ;</td><td>1 max</td><td>ACCEPT more food can be collected
less , time / energy , spent looking for food
easier to find food
e.g. ref to reduces competition from other colonies</td></tr>
<tr><td>2</td><td>(d)</td><td>(i)</td><td>reverse transcriptase ;</td><td>1</td><td>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

DO NOT CREDIT DNA (reverse) transcriptase</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
2	(d)	(ii)	**1** <u>mRNA</u> binds to **,** (gene) probes / cDNA / ssDNA **,** by complementary base pairing **;** **2** *idea that* the ***more*** active the gene the ***more*** mRNA produced **;** **3** during transcription **;** **4** ***more*** fluorescence indicates ***more*** mRNA (bound) **;**	**3 max**	**1** **DO NOT CREDIT** in the context of the gene probe binding to DNA **3** **IGNORE** translation
2	(d)	(iii)	**1** dopamine linked to **,** ADHD / addiction / risk-taking / adventurous behaviour / hyperactivity / erratic behaviour (in humans) **;** **2** *idea of* common mechanism in bees and humans (for adventurous behaviour) **;** **3** *idea that* as they are different organisms the mechanisms may not be comparable (even though apparently similar) **;** **4** AVP **;**	**3 max**	**1** **IGNORE** ref to schizophrenia / Parkinson's **This mark is for the effect of the *chemical* dopamine, not the dopamine receptors alone.** **2** e.g. ***both*** have **,** DRD4 / dopamine receptors e.g. dopamine has the same effect in ***both*** **4** e.g. other genes also involved in **,** bee / human **,** behaviour **Note:** 'both have dopamine receptors which are linked to adventurous behaviour' **= 1 mark** (mp 2 only) 'both have dopamine receptors and dopamine is linked to adventurous behaviour' **= 2 marks** (mps 2 & 1)
			Total	**18**	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)	*seedlings / coleoptiles have same* **S1** age **;** **S2** height / length **;** **S3** mass **;** **S4** genotype / genome **;** **S5** species **;** *procedure has same* **P1** same volume of solution applied **;** **P2** (named) feature of growth medium **;** **P3** watering regime **;** **P4** light **,** intensity / wavelength / duration **;** **P5** temperature **;**	**3 max**	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **S2 IGNORE** size / surface area / width **S3 IGNORE** size / weight **S4 ACCEPT** same genetic makeup **IGNORE** same genes **For all P points IGNORE** light ***direction*** (as this is an independent variable) **P1 IGNORE** ref to concentration of solution **ACCEPT** *idea of* consistency in application of **J** and **K** **P2** e.g. type / pH / fertiliser (applied) / minerals / ions **IGNORE** nutrients **P3** e.g. volume of water / time of watering **P4** e.g. distance from light source

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(ii)	*idea that* shows the response without treatment **or** *idea that* allows the **,** effect of the treatment / results / groups **,** to be **,** compared **;**	**1**	**IGNORE** improves validity / fair test (as an explanation is required) 'to show the effects of J and K' is not enough **CREDIT** 'observations' for treatments
3	(a)	(iii)	***ONLY CREDIT mark points in context of results, and not in context of general roles of auxin and giberellin*** ***J*** *is auxin because* **A1** inhibition of development of (lateral) buds (in group 2) **;** **A2** growth of **,** coleoptiles / group 5 **,** towards light **;** ***K*** *is gibberellin because* **G1** greater increase in **,** height / stem length (in group 3) **;** **G2** causes growth of (lateral) buds (in group 3) **;**	**3 max**	**J must be identified correctly for A marks to be awarded** **K must be identified correctly for G marks to be awarded** **A1 CREDIT** (group2) results show apical dominance **A2 CREDIT** (group 5) results show positive phototropism **IGNORE** plant (as all are plants) **G1 CREDIT** greater elongation **G2 CREDIT** (group 3) results do not show apical dominance
3	(b)	(i)	protein **;**	**1**	**ACCEPT** glycoprotein **IGNORE** polypeptide / channel / carrier / transport
3	(b)	(ii)	(synaptic) cleft **;**	**1**	**IGNORE** gap **IGNORE** neuromuscular
3	(b)	(iii)	acetylcholine esterase / ACh esterase **;**	**1**	**ACCEPT** phonetic spelling and ignore upper/lower case **IGNORE** AChE

Question			Expected Answer	Mark	Additional Guidance
3	(c)				**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
			mitochondria **;**		**ACCEPT** mitochondrion **DO NOT CREDIT** mitochondrial matrix
			oxidative phosphorylation **;**		**IGNORE** electron transport chain (as not a stage)
			lactate **;**		**ACCEPT** lactic acid
			creatine phosphate / phosphocreatine **;**		**DO NOT CREDIT** creatinine
			(cross-)bridge / (cross-)link **;** myosin (head) **;**	**6**	**DO NOT CREDIT** bond **ACCEPT** phonetic spelling
			Total	**16**	

Question			Expected Answer	Mark	Additional Guidance
4	**(a)**	**(i)**	3 **;**	**1**	**IGNORE** triplet
4	**(a)**	**(ii)**	4^3 **or** 4 x 4 x 4 **or** 4 x 4^2 **;**	**1**	
4	**(a)**	**(III)**	Several, triplet(s) / codon(s) **,** code for one amino acid **;** (some are used as) start / stop / termination **;** *idea that* mutation may **,** not result in change in amino acid / have a neutral effect / result in silent mutation **;**	**2 max**	**Must be clear that base combination is a group of 3 bases** **IGNORE** degenerate **DO NOT CREDIT** makes/ produces/ creates **,** amino acids **DO NOT CREDIT** deletion / insertion (as would create frame shift)
4	**(a)**	**(iv)**	adenine / A **and** cytosine / C **and** guanine / G **;**	**1**	**Mark the first 3 answers.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** adenosine **DO NOT CREDIT** cysteine **DO NOT CREDIT** glycine

Question			Expected Answer	Mark	Additional Guidance
4	(b)		*transcription* **1** DNA / gene **,** copied / transcribed **,** into mRNA **;** **2** free / activated **,** (RNA) nucleotides / (RNA) nucleoside triphosphates **;** **3** (line up by) complementary base-pairing / described **;** **4** (to) one / template / reference / sense , (DNA) strand ; **5** (catalysed by) RNA polymerase **;** *translation* **6** (mRNA moves to) ribosomes **;** **7** tRNA (molecules) bind to mRNA **;** **8** anticodon(s) **,** match / pair with / bind to **,** codons **;** **9** specific / correct **,** amino acid attached to tRNA **;** **10** formation of peptide bond between amino acids**;**	**6 max**	**Marks may be awarded from an annotated diagram** **1 IGNORE** 'used to make' **2 DO NOT CREDIT** DNA nucleotides **3 CREDIT '**A-T, C-G **and** A - U' **4 ACCEPT** 'non-coding' for 'template' **5 DO NOT CREDIT** in context of breaking H bonds **6 CREDIT** translation occurs at ribosomes **Note:** tRNA anticodons bind to mRNA codons **= 2 marks** (mps 7 & 8) **10 DO NOT CREDIT** dipeptide / polypeptide **,** bond
			QWC **;**	**1**	**Award** QWC if **two** mps from **1 – 5** have been awarded **before** **two** mps from **6 – 10** **Place a tick or a cross alongside the pencil icon to indicate whether or not the QWC mark has been awarded.**
			Total	**12**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td>
1 lag phase / slow increase
(in , population / number / percentage) ,
at start / initially / day 0 - 1 / during day 1 ;

2 log phase / exponential increase / rapid increase ,
day 1 - 3 ;

3 <u>rate</u> <u>of</u> <u>increase</u> , slows / less steep ,
days 3 - 4 / during day 3 ;

4 stationary phase / population levels off /
population stays at 100% ,
at end / finally / remaining days / days 4 - 6 ;

5 comparative figures quoted with 2 x-y readings ;
</td><td>4 max</td><td>
IGNORE explanations
ACCEPT ‘the population grows’ or ‘it grows’
(rather than increase)
DO NOT CREDIT ‘yeast grow(s)’

1 ACCEPT days 0 - 0.9
ACCEPT lasts 1 day

2 ACCEPT days 0.9 - 3.5

3 ACCEPT days 3.3 - 3.6

4 ACCEPT after day 3.5 - 4

5 Each unit must be quoted at least once

<table>
<tr><th>Time (days)</th><th>Yeast (% final population)</th></tr>
<tr><td>0</td><td>24</td></tr>
<tr><td>1</td><td>32</td></tr>
<tr><td>3</td><td>90</td></tr>
<tr><td>3.5 - 6</td><td>100</td></tr>
</table>

Take care to distinguish between an increase in percentage (by either quoting the figures for the days or by calculating the difference) and a percentage increase.
</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(ii)	**1** sugar converted to ethanol **;** **2** in <u>anaerobic</u> <u>respiration</u> **;** **3** sugar **,** undergoes glycolysis / converted to pyruvate **;** **4** pyruvate **,** loses carbon dioxide / decarboxylated / forms ethanal **;** **5** reduced NAD giving hydrogen to <u>ethanal</u> **;** **6** *idea of* NAD being **,** regenerated / recycled , (so) glycolysis continues ; **7** correct ref to **,** pyruvate decarboxylase / ethanol dehydrogenase **;**	**3 max**	**CREDIT** glucose / maltose / maltotriose for 'sugar' **2** **IGNORE** fermentation **5** **CREDIT** $NADH_2$ / NADH ($+H^+$) / red NAD
5	(a)	(iii)	*ethanol is* produced in **, all** yeast growth phases / **all** of the time **or** production of ethanol increases as yeast population increases **or** *idea that* ethanol is a normal (metabolic waste) product (of yeast) **;**	**1**	**IGNORE** ref to ethanol not being a secondary product **CREDIT** 'produced during normal growth' **CREDIT** follows growth curve for yeast **IGNORE** waste unqualified

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(iv)	**1** sugar concentration falls **too** low **;** **2** pH falls **too** low / conditions become **too** acidic / decrease in pH causes enzymes to denature **;** **3** high ethanol concentration **,** damages / poisons / inhibits **,** yeast **;**	**2 max**	**1** **ACCEPT** very low sugar concentration / sugar concentration decreases as used up **2** **ACCEPT** very low pH / very acidic **DO NOT CREDIT** 'falls and rises' **3** **ACCEPT** high ethanol concentration kills yeast
5	(b)		**1** glucose can **,** be used / enters glycolysis **,** directly / without being broken down (first) **;** **2** maltose**,** must **,** be hydrolysed / have glycosidic bonds broken ; **3** enzyme / maltase **,** only made when **,** needed / maltose present / glucose running out **;** **4** enzyme induced ***/*** gene(s) switched on **;** **5** transcription and translation / protein synthesis **,** takes time **;** **6** maltotriose requires, more (2) hydrolysis (reactions) / breaking of more (2) glycosidic bonds **or** enzyme to break down maltotriose made last **;**	**3 max**	**ACCEPT** 'monosaccharide' for glucose and 'disaccharide' for maltose and 'trisaccharide' for maltotriose throughout **1** **IGNORE** ref to glucose being used first / at start / immediately (as stated in Q)

Question			Expected Answer	Mark	Additional Guidance
5	(c)		*advantages of using yeast* **A1** less energy required ; **A2** does not need **,** high temperature / 300^{o}C / high pressure **;** **A3** can use waste material (as a substrate) **;** **A4** substrate is **,** sustainable / grown each year **;** **A5** process does not use up **,** oil reserves / fossil fuels **;** **A6** product is carbon neutral / no carbon footprint **;** **A7** AVP **;** *disadvantages of using yeast* **D1** time consuming / takes several days **;** **D2** needs **,** downstream processing / purification of product **;** **D3** is killed by product **;** **D4** can (only) use batch method **;** **D5** aseptic / sterile **,** conditions required **;** **D6** AVP **;**	**5 max**	**CREDIT** statements relating to yeast method only **IGNORE** statements relating to chemical method **IGNORE** ref to cost **A2** **ACCEPT** works well at low **,** temperatures / pressures **A3** **CREDIT** example e.g. sugar cane waste **A6** **IGNORE** ref to global warming / greenhouse gases **A7** e.g. yeast is readily available / easily accessible / yeast is in plentiful supply / yeast has simple growth requirements / process is less hazardous **D1** **ACCEPT** slower rate of reaction **D2** **ACCEPT** need to separate ethanol from yeast **D3** **ACCEPT** is inhibited by product **D5** **ACCEPT** more likely to become contaminated **D6** e.g. concentration of ethanol produced is limited
			QWC **;**	**1**	**Award** if 2 **A** marks **and** 2 **D** marks have been awarded **Place a tick or a cross alongside the pencil icon to indicate whether or not the QWC mark has been awarded.**
			Total	**19**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><th>Explanation</th><th>Letter</th></tr>
<tr><td>One gene with two alleles.
The alleles show codominance.</td><td>A</td></tr>
<tr><td>One gene with two alleles, located on an autosome (gene not sex linked).
One allele is dominant and the other is recessive.</td><td>E</td></tr>
<tr><td>Two genes for two different characteristics on two different chromosomes.</td><td>D</td></tr>
<tr><td>A sex linked gene with a dominant and a recessive allele.</td><td>B</td></tr>
<tr><td>Epistasis, where two genes interact to affect one phenotypic character.</td><td>C</td></tr>
</table>
;
;
;
;
;
</td><td>5</td><td>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
6	(b)	(i)	q^2 = 15 ÷ 60 or 0.25 **;** q = $\sqrt{0.25}$ or 0.5 **;** (p =) 0.5 **;**	3	**Correct answer (0.5) = 3 marks** even if no working shown **No mark for incorrect q^2 value but apply ecf afterwards** **ALLOW** ecf from candidates q^2 value (likely to be 0.87 or 0.9 (if candidate's q^2 = 0.75)) **ALLOW** ecf for p from candidate's calculated q value, (if q value between 0 and 1) **IGNORE** % values given for p (e.g. 50 % for 0.5)
6	(b)	(ii)	*in the pet shop* **1** population is **,** small / not (sufficiently) large **;** **2** not all members of the population are breeding **;** **3** *idea that* mating is not random **;** **4** *idea that* migration / emigration / immigration **,** is occurring **;** **5** *idea that* the non-brown rabbits could be colours other than white **;**	2	**IGNORE** ref to (natural) selection / mutation (as these do not apply to the 'artificial' population in the pet shop) **IGNORE** 'albinos are infertile'
			Total	**10**	

Question			Expected Answer	Mark	Additional Guidance
7	(a)		**1** pioneers arrive **,** ***before*** climax / ***earlier*** **;** **ora** **2** pioneer communities subject to **,** ***greater*** / ***more*** **,** change / succession / replacement **;** **ora** **3** pioneer community (usually) has **,** ***less*** / ***lower*** **,** biodiversity **;** **ora** **4** *idea that* pioneer community is (often) ***less*** **,** stable / self-sustaining **;** **ora** **5** pioneer community has ***lower*** biomass **;** **ora** **6** AVP **;**	**2 max**	**Note: All mark points are comparative** **1** **CREDIT** pioneers arrive first / climax arrive last **6** e.g. species in pioneer community better adapted to (named) abiotic factor(s) **and** those in climax community better adapted to (named) biotic factor(s)

Question			Expected Answer	Mark	Additional Guidance
7	(b)		**1** decomposition is break down **,** dead matter / waste **or** decomposition is conversion of organic matter to inorganic **;** **2** denitrification is conversion of nitrates to nitrogen (gas) **;** **3** decomposition increases **,** mineral / nitrate **,** supply **and** denitrification reduces **,** mineral / nitrate **,** supply **;**	**2 max**	**1 IGNORE** putrefication **1 CREDIT** for **inorganic:** carbon dioxide / CO_2 / water / H_2O / ammonium compounds / ammonium ions / NH_4^+ **IGNORE** ammonia / NH_3 **2 CREDIT** correct formulae (NO_3^- and N_2) **DO NOT CREDIT** nitrogen oxides **3 CREDIT** decomposition returns , mineral / nitrate, to soil **and** denitrification removes mineral / nitrate, to soil
7	(c)		**1** conservation maintains **,** ecosystem / biodiversity / species / habitats **or** conservation involves **,** active / sustainable **,** management of **,** ecosystem / resource / habitat **;** **2** preservation leaves **,** ecosystems / habitats **,** undisturbed **;**	**2**	**IGNORE environment for MP1 and 2** **ACCEPT** named resource **ACCEPT** unchanged/ not disrupted / no physical intervention **IGNORE** ref to preservation in any context other than that of conservation/preservation

Question			Expected Answer	Mark	Additional Guidance
7	(d)		**1** nitrogen fixation is the conversion of (atmospheric) nitrogen into **,** ammonia / ammonium compounds / ammonium ions **;** **2** nitrification is the conversion of **,** ammonia / ammonium compounds /ammonium ions **,** into nitrite / nitrate **;** **3** correct ref to microorganisms involvement in both processes **;**	**2 max**	**1** **CREDIT** N_2 / NH_3 / NH_4^+ **2** **CREDIT** NH_3 / NH_4^+ **CREDIT** NO_2^- / NO_3^- **DO NOT CREDIT** nitrate to nitrite **3** e.g. nitrogen fixation involves **,** *Rhizobium* / *Azotobacter* / *Nostoc* **and** nitrification involves **,** *Nitrosomonas* / *Nitrobacter*
			Total	**8**	